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Lowland Riparian Butterflies of the Great Basin and Associated Areas

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Abstract. Many species of butterflies are characteristic of or restricted to riparian habitats in the valleys of the Great Basin region. These belong to three elements based on distribution: northern, southern and widespread. Southern species richness decreases upstream from the Colorado River. Northern species richness decreases downstream and towards the central Great Basin from two distinct, but related, centers: the Humboldt River drainage and the western Nevada drainages. Distribution patterns resemble those demonstrated for birds.

The Great Basin of western United States is a large area of mainly internal drainage between the Rocky Mountains and the Sierra Nevada. It includes western Utah, most of Nevada, and portions of eastern California, southern Oregon and southern Idaho. The overriding context of the Great Basin is aridity. Most biological interest has centered in the many more mesic mountain ranges where diversity tends to be greatest. For each mountain range, however, there are associated valley systems which have received little study. Several of these valleys are relatively well watered by rivers or intermittent streams, some are fed by springs and still others are dry. The Colorado River and its tributaries drain portions of the southern Great Basin area and tributaries of the Snake River drain the extreme northern portion. The remainder of the region has no external drainage.

Biogeographic affinities and distributions of Great Basin fish have been analyzed by Smith (1978). Johnson (1978) discussed lowland riparian distributions of birds. Until recently, the distributions of butterflies in the Great Basin were largely unknown, especially in the valleys. I have collected considerable data from such situations over the last several years. These are now adequate to allow an analysis of the riparian butterfly distribution of the Great Basin, especially Nevada, and immediately adjacent areas.

Drainages and Habitats

The name "Great Basin" is a misnomer. It is not one large basin but is a physiographic province composed of numerous smaller drainage areas

many of which are presently unconnected. Nevada, alone, contains 14 hydrographic regions and basins. These each contain a number of hydrographic areas for a total of 232 in Nevada (Anonymous, 1971). The regions can be grouped into three categories: (1) mostly linear basins with major rivers (Snake, Humboldt, Truckee, Carson, Walker and Colorado), (2) basins with no major stream flow (Black Rock Desert, Great Salt Lake, Escalante Desert and Death Valley) and (3) regions with groups of mostly closed and often dry valleys (Northwest, Western, West Central and Central). Further discussion and the water dynamics of these areas were presented by Anonymous (1971).

The intermountain valleys of Nevada are vegetated by one of several shrub communities. In southern Nevada, these are dominated by creosote bush *(Larrea tridentata)*. In more saline areas in the south, and especially further north in western Nevada, shadscale *(Atriplex confertifolia)* is predominant. The third major valley community which occurs over most of the remainder of Nevada is an extensive and monotonous sagebrush *(Artemisia tridentata)* community.

Riparian communities of various types occur along water courses in many of the major valleys, in some of the smaller valleys and near springs and seeps. These may be extremely diverse biologically and cover substantial habitat area or be depauparate, quite small and isolated. Occurring along many streams are stands of cottonwood *(Populus fremontii)* and willow *(Salix* spp.). Occasional marshes and wet meadows occur. Further from the main channels, especially on alkaline soils, are associations dominated by iodinebush *(Allenrolfea occidentalis)* and saltgrass *(Distichlis spicata)*. The latter is often the only riparian vegetation in poorly watered valleys. There is an additional kind of riparian association in southern Nevada consisting principally of an aborescent growth of phreatophytic mesquites *(Prosopis* spp.) and acacia *(Acacia greggii)*.

Methods

I collected most of these data during the last ten years at 65 sites in Nevada and southwestern Utah (Fig. 1). The Nevada localities include 12 of the 14 delineated hydrographic regions of the state. Locations were visited on several occasions at selected times of the year to obtain as complete a seasonal representation of the butterfly fauna as possible. Species lists were developed from these collections in addition to records from others and the literature (especially Emmel and Emmel, 1973; Ferris and Brown, 1981).

A rather diverse assortment of taxa were included as riparian components of the butterfly fauna (Tables 1, 2). All are principally distributed in and many are restricted to association with riparian vegetation at lowland sites in Nevada. A number similarly occur in wet

Fig. 1. Sample sites for riparian butterflies in the Great Basin and associated areas. Numbers refer to localities keyed in Tables 1 and 2. Solid arrows indicate closest phyletic relationships (generally in direction of decreasing faunal diversity); dashed arrows indicate relationships between hydrographic regions. Dashed line indicates approximate boundary between northern and southern riparian butterfly faunas.

places in montane situations. Included are species commonly associated with the activities, usually agricultural, of man (e.g., *Colias eurytheme, C. philodice, Pieris rapae)*. Also included is *Pieris protodice* which occurs over a broad range of habitats in early spring and occasionally in fall, reaching its greatest abundance at wetter areas through the summer. Most taxa, however, are closely associated with riparian vegetation among which they find their larval foodplant. Excluded are principally montane taxa which occasionally are found and sometimes breed in the riparian valleys (e.g., *Hesperia comma, Nymphalis milberti, Limenitis weidemeyerii*), various ubiquitous species which are not particularly associated with wet areas (e.g., *Pyrgus communis*) and wandering, sporadic and otherwise unclassified taxa.

Two species warrant special mention. *Plebejus melissa* is represented in southern Nevada by a distinctive phenotype restricted to lowland sites in the Colorado River drainage. Further north, nominate *melissa* occurs in riparian situations but also in several other habitats and is not included as a riparian species. *Polygonia satyrus* is also a riparian species and

occurs at some of the northern Nevada sites. Its presently known distribution is spotty and it is excluded from the tabulations.

Species Composition

The butterfly fauna of the Great Basin valleys is composed of a number of species which are narrowly and usually disjunctly distributed wherever suitable habitat occurs. Away from the immediate riparian vegetation, whether saltgrass flats or marshes, riparian associated butterflies are usually absent. A total of 62 taxa belonging to 46 species are considered typical of or restricted to these riparian habitats (Table 1, 2). These belong to three distributional elements: (1) a southern group (25 taxa) with largely desert affinities, (2) a northern group (30 taxa) with diverse affinities and (3) a widespread group (7 taxa) most with a wide distribution throughout North America. The occurrence and distribution of these groups and of the individual taxa themselves correspond to drainage basins (Table 1, 2). The southern taxa, with the exception of nonpermanent populations or strays, occur exclusively in the Colorado River and Death Valley drainages and in the southernmost Central Region of Nevada. Northern taxa occur primarily in the remainder of the state. There is very little overlap; seven of the northern taxa occur in various combinations with southern taxa at six northern sites of the Colorado River drainage.

The southern species are most diverse along the Colorado River from southern Nevada southward (Table 1). There is little dilution along the lower portions of two of its tributaries (Virgin and Moapa rivers, Fig. 2).

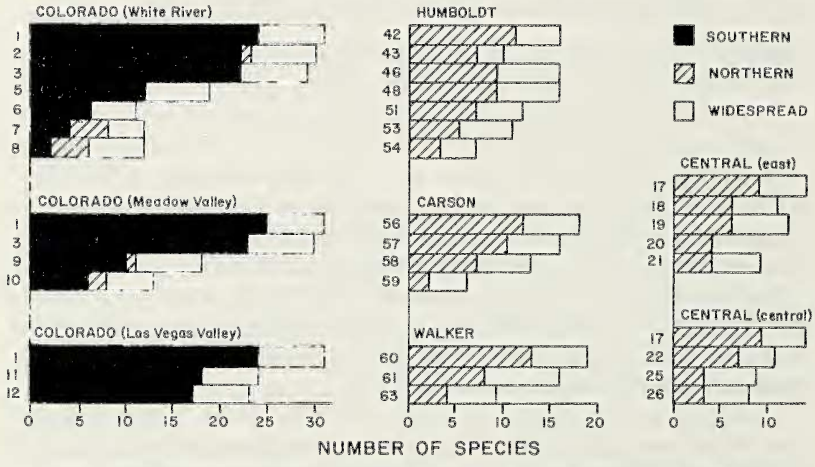

Fig. 2. Taxa group composition of riparian butterfly faunas in the Great Basin and associated areas. Numbers on vertical axis refer to sample sites as keyed in Tables 1 and 2.

The drier Las Vegas Valley (to Corn Creek) still has a fair diversity of species. North of these areas and corresponding to a general increasing isolation of riparian habitat, a marked reduction in the number of species is found. Relative abundance seems to decline in many species also. The most northern points (Lund, Sunnyside, Hiko, Ursine) have six or fewer southern species. The decline in species richness may reflect distance from source populations, isolation and possibly the severity of winters. Suitable larval foodplants are present north of these southern species' distributions. For example, willow (*Salix*), the host of *Limenitis archippus*, occurs at most sample stations but the butterfly occurs only along the Colorado River and its immediate tributaries. Mesquite (*Prosopis*), the host of *Apodemia palmerii* and *Ministrymon leda*, similarly occurs in Meadow Valley but not the butterflies. Other examples exist.

The two sample sites each from the Death Valley Basin and the southern Central Region are inhabited by a depauparate assemblage of Colorado River Basin species and both show similar upstream impoverishment. Only one species (*Pseudocopaeodes eunus*) unknown in the Colorado drainage occurs in the Death Valley Basin.

Brephidium exilis has a distribution similar to the southern taxa but regularly wanders northward in summer, often occurring (and breeding) at the northern border of the state. How far north *exilis* is permanently established has not been determined (and it is not included in the tabulations). A number of the other southern taxa irregularly wander northward and are occasionally found, sometimes breeding, at northern stations. These include *Nathalis, Precis, Danaus, Leptotes* and both species of *Hemiargus*. Their permanent residency appears to be within the limits of the southern group distribution (but perhaps not as far as indicated in Table 1), and thus all northern Nevada records are excluded from the tabulations.

Northern drainages in Nevada collectively have more taxa than the southern drainages (Table 1, 2) but have fewer species (17 vs. 25). Individual drainages, however, have considerably fewer taxa than the Colorado River Basin (Table 2). The number of species decreases more gradually from the periphery inward than in the south (Fig. 2). Nine of the 11 northern species ocurring along the Humboldt River at Elko are still present as far downstream as Dunphy and Battle Mountain and seven occur at Winnemucca. The Reese River hydrographically is a tributary of the Humboldt River but has none of the latter's endemics and instead has taxa from both the Carson/Walker drainages and the Central Region. This may be partially a result of the discontinuity of the downstream portion of the Reese River where there is very little riparian vegetation.

In the Central Region, seven and six of the nine northern species at Ruby Valley occur as far as Newark and Steptoe valleys, respectively.

Outlying points in this region have noticeably impoverished local faunas. No northern species are found at Mina and only *Polites sabuleti* is found at Monitor Valley. *Colias philodice* and *P. sabuleti* are at Fish Lake Valley (the phenotype of the latter is closer to that in the Carson and Walker drainages than to those at other Central Region sites). Seven additional sites (Spring, Lake, Antelope, Kobeh and Railroad valleys, Duckwater and Currant) have two to four northern group species (all have *Polites sabuleti* and five have *Hesperia uncas*).

Generalizations about the Snake River Basin localities in Nevada are more difficult. These are upstream sites of drainages extending north into Idaho from which no specific site data are available. A composite list generated from Ferris and Brown (1981) indicates a maximum of 10-12 northern species present in the main Snake River drainage. The faunas of the Nevada sites (Table 2) thus are only a somewhat impoverished representation of the Snake River fauna. The Nevada points basically are all similar in species composition and related to those of the Central Region and the Humboldt River Basin.

Three similar river systems exist in western Nevada. The relatively wet (compared with other Great Basin mountains) east slope of the Sierra Nevada and nearby mountains support extensive areas of adjacent valley riparian vegetation with an associated riparian butterfly fauna in the Truckee, Carson and Walker river basins. Both the number of species involved and the gradual impoverishment downstream in the Carson and Walker basins (Fig. 2) is similar to that occurring in eastern Nevada.

All the drainages and regions in northern Nevada are rather similar. The relatively small number of upstream species and the gradual decrease downstream (except possibly the Snake drainage, see above) are a common theme which distinguishes them from the southern drainages. Of the 17 northern species, seven occur in all five of the major northern drainages and regions for which there is sufficient data (Carson, Walker, Snake, Central, Humboldt) and four others occur in four of the five (Table 2). Three species are restricted to the Carson and/or Walker basins and two to the Snake and/or Humboldt basins. *Hesperia uncas* occurs in the Central Region and in the Humboldt and Walker river basins.

One further feature alluded to above distinguishes the southern drainages from the internal drainage basins of the north. In the Colorado River Basin (and apparently the Death Valley Basin and the southern Central Region) the riparian faunas are rich downstream and become depauparate upstream. The converse is true in the Humboldt, Carson and Walker basins. In these, the greatest species richness is in the upper portions of the major valleys. This reflects a basic physiogonomic difference between the two. The southern valleys drain relatively arid mountains and most eventually empty into a major river, the Colorado, with external drainage. The northern valleys drain well watered mountains

and terminate in internal, alkali sinks. The unifying feature is faunal impoverishment towards the central Great Basin and richness peripherally (also well illustrated by the Central Region data).

One other area must be discussed along with the possible influence of man's activities. The Truckee River Basin of western Nevada has been connected by canal (completed in 1905) to the Carson River Basin through Fernley in the West Central Region. Considerable riparian vegetation occurs along the canal banks and undoubtedly provides a dispersal corridor across otherwise uninhabitable desert. The fauna of the area (e.g., Fernley) is most closely related to that of the Carson and Walker drainages (Table 2). The general area (Wadsworth to Fallon of the Truckee and Carson basins) is the only area where *Limenitis archippus* of eastern Nevada flies with *L. lorquini* of western Nevada.

Phenotypic Differentation

Refinement of the pattern described above at the species level to a lower taxonomic level (subspecies, etc.) reveals a more complex situation. In northern Nevada, *Pseudocopaeodes eunus* occurs in the Walker, Truckee and Carson river basins only as a downstream species. Most are of a bright phenotype near *P. e. wrightii* but the Eagle Valley population in the Carson River basin is distinct and approaches nominate *P. eunus* in phenotype. Whether the Truckee basin *P. eunus* (dispersal from the Walker basin) and the occurrence of *L. archippus* in the Carson and Truckee drainages (dispersal from the Humboldt basin) is recent (post-canal) or not is unknown. *P. e. wrightii* also occurs in two isolated colonies in the Reese River and Big Smoky valleys.

The *Polites sabuleti* of the Truckee, Carson, Walker and most of the Humboldt river basins and of the Black Rock Desert Region are phenotypially similar to nominate *P. sabuleti*. Another similar population occurs in Fish Lake Valley in the western part of the Central Region. The eastern portion of the Central Region is inhabited by a very dark *P. sabuleti* phenotype which is undescribed. In central Nevada, including the southernmost sites of the Central Region (Newark, Railroad, Big Smoky, Montir, etc. valleys) and Humboldt River Basin (Reese River), there are very pallid populations of *P. sabuleti* which again are undescribed. In the Big Smoky Valley and Reese River area, a particularly pallid and unique *Cercyonis oetus (pallescens)* occurs.

The Walker, Carson, Truckee and most of the Humboldt drainage are inhabited by a large and pale *Satyrium sylvinus* seemingly near *desertorum*. In the Snake River Basin and Central Region, *S. sylvinus* is represented by *putnami*. This is a widespread Rocky Mountain taxon in the eastern Great Basin. At the extreme northern (Paradise Valley) and southeastern (Alpha) sample sites of the Humboldt River basin, the

sylvinus are assignable to the nominate subspecies and *putnami*, respectively. The phenotype of *Limenitis archippus* near nominate *archippus* occurs in the Snake drainage while *L. a. lahontani* is nearly restricted to the Humboldt drainage (see above). *Coenonympha ampelos ampelos* occurs in all northern drainages except in the Humboldt Valley (but the population at Reese River is also phenotypically this subspecies) and in Ruby Valley. The subspecies *elko* is restricted to the Humboldt and Ruby valleys. Similarly, the *Cercyonis pegala* of eastern and western Nevada differ subspecifically. The Snake and Humboldt river basins and the Central Region are inhabited by several similar undescribed populations which have minor but identifiable differences in some valleys (e.g., between Steptoe Valley and Newark Valley). The Carson Valley *pegala* is much different (something allied to but not *gabbii*) and another *pegala* (resembling the phenotype in eastern Nevada) is found in the upper Walker River drainage.

The Northwestern Region which extends into northeastern California and south-central Oregon is represented by a single sample site in Nevada. The butterflies of this site are of complex affinities (Table 2) and the area has an endemic *Cercyonis pegala* subspecies (*stephensi*). Another *Cercyonis pegala*, a *gabbii*-like insect (but different from that of Carson Valley), occurs in the Black Rock Desert Region. *Lycaena rubidus* and *Satyrium sylvinus* here are of the nominate phenotypes.

The fauna of certain northern points of the Colorado River drainage, as mentioned above, contain northern group species. *Satyrium sylvinus putnami* occurs at three of these. The *Polites sabuleti* at Sunnyside is similar to the phenetically dark populations occurring from Ruby Valley to Steptoe Valley in northeastern Nevada. Similarly, the *Cercyonis pegala* of the Lund area is more like that in Steptoe Valley than the one in Newark Valley. *Hesperia uncas* of the White River Valley (Lund, Sunnyside) are of a pale, low elevation phenotype similar to *lasus*. The population of *Speyeria nokomis* at Ursine is an isolate (as are all populations of this species). All of these represent the southernmost occurrences of the taxa in the Great Basin of Nevada.

All areas of both northern and southern drainages have between three and seven widespread species. One, *Ochlodes yuma*, is widespread but occurs only in isolated pockets with its foodplant (Scott et. al., 1977) and is apparently absent from the Snake and Carson river basins. The absence of the widespread *Vanessa atalanta* appears to be due to the scattered distribution of its host, *Urtica*. *Pieris protodice* and *Colias eurytheme*, on the other hand, occur at every sample station. The remaining species occur at an intermediate number of sites (Table 1, 2).

The southern species uncommonly occur away from the lowland riparian habitat. A few (e.g., *Leptotes, Hemiargus, Precis, Danaus*) are

encountered in montane situations but only as summer residents or wanderers. These are the same taxa which establish apparently non-permanent colonies north of the southern drainages. Their centers of abundance are in the lowlands. Many of the northern taxa, in contrast, have distributions which extend into the wetter mountain canyons. Only *Pseudocopaeodes, Hesperia, Polites* (except in a very few situations), *Papilio, Strymon sylvinus* ssp., *Phyciodes pratensis* ssp., *Limenitis archippus, Coenonympha ampelos elko* and *Cercyonis pegala* seem restricted largely to the valleys. Similarly, all of the widespread riparian species, except *Ochlodes*, also have partly montane distributions.

Discussion

The riparian distribution of Great Basin butterflies is strikingly similar to the distribution of riparian birds (Johnson, 1978). There are northern and southern bird taxa groups with replacement coincident with that found for butterflies at the approximate northern limits of the Death Valley and Colorado River basins (Fig. 1). Impoverishment away from major drainages and into the central Great Basin is common to both birds and butterflies. Similarly, the general decrease in species richness inward from the periphery of the Great Basin is found in montane bird faunas (Johnson, 1975, 1978; Brown, 1978), mammals (Brown, 1978), plants (Harper et al., 1978) and butterflies (unpubl. data). In fish, there is an increasing impoverishment from the periphery to the interior of the Great Basin (Smith, 1978). Endemism is considerably higher in fish, as is expected of a taxonomic group with low dispersal capacity, than in butterflies and, especially, birds. However, fish tend to be more broadly distributed in the north, unlike butterflies.

The partial two way gradient with distribution centers and some phenotypic differentiation in eastern and western Nevada, respectively, suggests that the butterflies of the eastern and western drainages of the northern portion of the Great Basin in Nevada have had somewhat separate evolutionary histories. Dispersal and/or differentiation is probably post-Pleistocene in most or all instances with isolation of populations increasing as the huge Pleistocene lakes dried. Differences between the Humboldt and the Carson and Walker drainages are indicative of this (Table 2). Dispersal differences involves species occurring in one drainage group but not the other (*Speyeria cybele, Limenitis*) and subspecific differentiation (*Phyciodes, Coenonympha, Cercyonis*) between the two source areas. Yet a common history as part of the Lahontan drainage is indicated by the occurrence in both areas of relatively undifferentiated *Polites* and *Satyrium*. Furthermore, *Hesperia uncas, Polites sabuleti, Cercyonis pegala*, and *Cercyonis oetus* show a degree of infrasubspecific differentiation in some areas (especially in the Central Region) of the Great Basin.

Preliminary evidence indicates that valley systems can act as island centers of evolution similar to (and possibly stronger than judging from the comparative degree of phenetic differentiation) montane islands. Additional collecting and comparisons are needed, however, to further refine degrees of affinity between isolated valley populations. *Speyeria nokomis* in Ruby Valley, for instance, show definite phenetic similarity with the more eastern nominate *nokomis*, an attribute not shared with other populations of the species considered here (see also Ferris and Fisher, 1971).

The distributions of the taxa listed in Tables 1 and 2 can be viewed on a yet broader biogeographic scale than in the previous section: (1) taxa widely distributed in western United States or beyond, (2) taxa regionally distributed across several drainage basins or hydrographic regions but not restricted to the Great Basin and (3) endemic taxa. The biogeographic affinities of the southern group is principally with the North American deserts to the south. Most species are also regional, occurring in more than one drainage basin. *Pholisora gracielae* and possibly the *Plebejus melissa* ssp. appear endemic to the Colorado River Basin and *Pseudocopaeodes eunus alinea* is endemic to the Death Valley Basin. The northern group of taxa has complex affinities. Some (*Polities sabuleti sabuleti, Pieris occidentalis, Colias philodice, Lycaena rubidus, Plebejus saepiolus*) are widespread through much of the northwestern United States. In eastern Nevada, *Satyrium sylvinus putnami* and *Phyiodes pratensis camillus* with Rocky Mountain affinities are definitely regional in their Great Basin range. They occur in the Central Region, Snake River Basin, southern sites of the Humboldt River Basin and at northern points in the Colorado River Basin. *Papilio oregonius* and *Limenitis archippus archippus* have a northern distribution and reach their southern limits in the northern Great Basin. In western Nevada, *Satyrium sylvinus sylvinus, Speyeria cybele leto, Phyciodes pratensis pratensis, Limenitis lorquini* and *Coenonympha ampelos ampelos* have their centers of distribution in the Sierra Nevada and westward. The remainder of the northern taxa are largely Great Basin endemics at the subspecies level. Some are narrowly restricted to individual drainages (e.g., an undescribed *Phyciodes pratensis* in the Humboldt River Valley) and several others occur in two or more hydrographic regions.

The theory of island biogeography has been widely applied to the biota of the montane islands of the Great Basin (Johnson, 1975, 1978; Brown, 1971, 1978; Harper et al., 1978) and, as can be seen here, certainly also apply to the disjunct patches of riparian habitat in the valleys. Present distributions of these riparian habitat restricted butterflies give some indication of their dispersal patterns and capacity, of barrier and distance effects resulting in depauparate faunas and of rates of differentiation. There is evidence also of modern local extinction of one species,

Ochlodes yuma, due both to natural causes and to human activities. The larval foodplant of this skipper, *Phragmites communis*, has a wide, but patchy distribution in the Great Basin. The plant and consequently the insect have been eliminated by man from at least two Nevada sites (Tule Springs, Clark County and Lida, Esmeralda County). Near Mina (Mineral County) exists a still healthy colony of *Phragmites*, but the once present *O. yuma* has disappeared. Other extensive and apparently suitable stands (e.g., at Carson Lake) harbor no *O. yuma* possibly the result of local extinction. The lack of a fossil record or even historical records, however, preclude inferences on the role of extinction on present distribution patterns. Some butterfly species absences clearly are due to absence of proper foodplants. Whether other absences are the result of some combination of butterfly dispersal incapabilities, chance or extinction is a matter of conjecture.

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Table 1. Riparian butterflies of the Colorado River and associated drainages in southern Nevada.[1,2]

	COLORADO RIVER BASIN												DEATH VALLEY BASIN		CENTRAL REGION (south)	
	1 Colorado River	2 Virgin River	3 Overton/Moapa	4 Coyote Springs	5 Pahranagat Valley	6 Hiko	7 Sunnyside	8 Lund	9 Meadow Valley	10 Ursine	11 Las Vegas	12 Corn Creek	13 Ash Meadows	14 Beatty	15 Pahrump	16 Indian Springs
SOUTHERN GROUP																
Erynnis funeralis	X	X	X	–	–	–	–	–	–	–	X	–	–	X	–	–
Pholisora libya libya	X	X	X	X	X	–	X	–	X	–	X	X	X	X	–	X
Pholisora gracielae	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–
Copaeodes aurantiaca	X	X	X	–	X	–	–	–	–	–	X	X	–	–	–	–
Hylephila phyleus muertovalle	X	X	X	–	X	–	–	–	X	–	X	X	X	X	X	X
Pseudocopaeodes eunus alinea	–	–	–	–	–	–	–	–	–	–	–	–	X	X	–	–
Polites sabuleti chusca	X	X	X	–	X	–	–	–	–	X	X	X	X	X	X	–
Atalopedes campestris campestris	X	X	X	–	X	X	–	–	–	–	X	X	X	X	X	–
Lerodea eufala	X	X	X	–	X	–	–	–	–	–	X	X	X	X	X	–
Eurema nicippe	X	X	X	X	–	–	–	–	–	–	X	X	X	X	–	–
Nathalis iole	X	X	X	X	–	–	–	–	X	–	X	X	X	–	X	–
Atlides halesus estesi	X	X	X	X	–	–	–	–	X	–	X	X	X	–	X	X
Ministrymon leda	X	X	X	X	–	–	–	–	–	–	X	–	X	–	X	–
Leptotes marina	X	X	X	X	X	X	–	–	X	X	X	X	X	–	X	X
Hemiargus ceraunus gyas	X	X	X	X	X	X	–	–	X	–	X	X	X	X	X	X
Hemiargus isola alce	X	X	X	X	X	X	X	–	X	X	X	X	X	X	–	X
Plebejus melissa ssp./3	X	X	X	–	X	X	X	X	X	X	–	–	–	–	–	–
Calephelis nemesis californica/4	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–
Calephelis wrighti	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Apodemia palmerii palmerii/5	X	X	X	X	–	–	–	–	–	–	X	X	X	–	X	X
Chlosyne lacinia crocale	X	X	X	–	–	–	–	–	–	–	X	X	–	–	–	–
Phyciodes tharos distincta	X	–	–	–	–	–	–	–	–	–	–	X	–	–	–	–
Precis coenia	X	X	X	–	X	X	X	X	X	X	X	X	X	X	–	–
Limenitis archippus obsoleta	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–
Danaus gilippus strigosus	X	X	X	X	X	–	–	–	X	X	X	X	X	X	X	X
NORTHERN GROUP																
Hesperia uncas lasus	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–
Polites sabuleti ssp./6	–	–	–	–	–	–	X	–	–	–	–	–	–	–	–	–
Colias philodice	–	–	–	–	–	–	X	X	–	–	–	–	–	X	–	–
Satyrium sylvinus putnami	–	X	–	–	–	–	–	–	X	X	–	–	–	–	–	–
Speyeria nokomis apacheana	–	–	–	–	–	–	–	–	–	X	–	–	–	–	–	–
Phyciodes pratensis camillus	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–
Cercyonis pegala ssp./6	–	–	–	–	–	–	–	X	–	–	–	–	–	–	–	–
WIDESPREAD GROUP																
Ochlodes yuma	X	X	X	–	X	X	–	X	X	–	X	X	X	X	–	–
Pieris protodice	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pieris rapae	X	X	X	X	X	X	X	X	X	–	X	X	X	X	X	–
Colias eurytheme	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Lycaena helloides	X	X	X	–	X	X	X	X	X	X	–	–	–	–	X	X
Nymphalis antiopa	X	X	X	–	X	–	–	X	X	X	X	X	–	X	X	–
Vanessa atalanta rubria	X	X	X	–	X	–	–	–	X	X	X	X	X	–	–	–

Table 2. Riparian butterflies of the northern Nevada drainages.[1,2]

	CENTRAL REGION (north)															NORTHWEST REGION	BLACK ROCK DESERT		SNAKE RIVER BASIN					
	17 Ruby Valley	18 Currie	19 Steptoe Valley	20 Spring Valley	21 Lake Valley	22 Newark Valley	23 Antelope Valley	24 Kobeh Valley	25 Duckwater	26 Currant	27 Railroad Valley	28 Monitor Valley	29 Big Smoky Valley	30 Mina	31 Fish Lake Valley	32 Dufurrena	33 Kings River Valley	34 Quinn River Valley	35 Jackpot	36 Contact	37 Mountain City	38 Wildhorse	39 Charleston	40 Independence Valley
NORTHERN GROUP																								
Pseudocopaeodes eunus wrightii	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-
Pseudocopaeodes eunus eunus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hesperia uncas lasus	-	-	-	X	X	-	-	-	X	X	X	-	X	-	-	-	-	-	-	-	-	-	-	-
Polites sabuleti sabuleti	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	X	X	-	-	-	-	-	-
Polites sabuleti ssp./3	X	X	X	X	X	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polites sabuleti ssp./4	-	-	-	-	-	X	X	X	-	-	X	X	X	-	-	-	-	-	-	-	-	-	-	-
Papilio oregonius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
Pieris occidentalis	X	X	X	-	-	X	-	-	-	-	-	-	-	-	-	X	-	X	X	X	X	X	X	X
Colias philodice	X	X	X	X	X	X	X	X	-	-	-	-	X	-	X	X	X	X	X	-	-	X	X	X
Lycaena rubidus sirius/5	X	X	X	-	-	X	-	-	-	-	-	-	-	-	-	X	-	X	X	X	X	X	X	X
Satyrium sylvinus sylvinus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-	-	-	-
Satyrium sylvinus ssp./6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Satyrium sylvinus putnami	-	X	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	X	-	-	X	-	X
Plebejus saepiolus saepiolus	X	-	-	-	-	X	-	-	-	-	-	-	X	-	-	-	-	-	-	X	X	X	X	-
Speyeria cybele leto	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Speyeria nokomis apacheana/7	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-
Phyciodes pratensis pratensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	X
Phyciodes pratensis camillus	X	-	X	X	X	X	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phyciodes pratensis ssp./8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Limenitis archippus archippus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-
Limenitis archippus lahontani	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Limenitis lorquini	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Coenonympha ochracea mono	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coenonympha ampelos ampelos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	X	-	X	X	X	X	X
Coenonympha ampelos elko	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cercyonis pegala stephensi/9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Cercyonis pegala ssp./10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cercyonis pegala ssp./11	X	X	X	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	X	X
Cercyonis pegala ssp./12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cercyonis pegala gabbii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-
WIDESPREAD GROUP																								
Ochlodes yuma	-	-	-	-	-	-	-	-	X	X	X	-	X	X	-	-	X	-	-	-	-	-	-	-
Pieris protodice	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pieris rapae	X	X	X	-	X	X	X	-	X	X	X	X	X	-	-	X	X	X	X	X	-	-	-	X
Colias eurytheme	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Lycaena helloides	X	X	X	X	X	X	X	X	X	X	X	-	X	-	X	X	X	X	X	X	X	X	X	X
Nymphalis antiopa	X	X	X	-	X	-	-	-	-	X	-	-	X	-	-	X	X	X	X	X	X	X	X	X
Vanessa atalanta rubria	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-	X	-	-	X	-	-

	GREAT SALT LAKE BASIN	HUMBOLDT RIVER BASIN													WEST CENTRAL REGION	CARSON RIVER BASIN				WALKER RIVER BASIN				TRUCKEE RIVER BASIN	
	41 Thousand Springs	42 Elko	43 Carlin	44 Pine Valley	45 Alpha	46 Dunphy	47 Beowawe	48 Battle Mountain	49 Central Reese	50 Reese River	51 Winnemucca	52 Paradise Valley	53 Rye Patch	54 Lovelock	55 Fernley	56 Carson Valley	57 Eagle Valley	58 Stillwater	59 Carson Lake	60 Sweetwater	61 Mason Valley	62 Wabuska	63 Schurz	64 Washoe Lake	65 Wadsworth
NORTHERN GROUP																									
Pseudocopaeodes eunus wrightii	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X	-	-	-	X
Pseudocopaeodes eunus eunus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Hesperia uncas lasus	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Polites sabuleti sabuleti	X	X	X	-	-	X	X	X	-	-	X	-	X	-	X	X	X	X	X	X	X	X	-	X	X
Polites sabuleti ssp./3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polites sabuleti ssp./4	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Papilio oregonius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pieris occidentalis	X	X	X	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	-	X	X	X
Colias philodice	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X
Lycaena rubidus sirius/5	X	X	X	X	X	X	X	X	-	X	X	X	-	-	X	X	X	X	-	X	X	-	-	-	X
Satyrium sylvinus sylvinus	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Satyrium sylvinus ssp./6	-	X	-	-	-	X	X	X	-	-	X	-	X	-	X	X	X	X	-	X	X	-	X	X	X
Satyrium sylvinus putnami	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plebejus saepiolus saepiolus	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	X	X	-	-	X	-	-	-	X	-
Speyeria cybele leto	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-
Speyeria nokomis apacheana/7	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-
Phyciodes pratensis pratensis	-	-	-	-	-	-	-	-	-	X	-	-	-	-	X	X	X	-	-	X	X	-	-	-	-
Phyciodes pratensis camillus	X	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phyciodes pratensis ssp./8	-	X	X	X	-	X	X	X	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Limenitis archippus archippus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Limenitis archippus lahontani	-	X	-	-	-	X	X	X	-	-	X	-	X	X	X	-	-	-	-	-	-	-	-	-	X
Limenitis lorquini	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	X	X	-	X	X	-	X	X	X
Coenonympha ochracea mono	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
Coenonympha ampelos ampelos	X	-	-	-	-	-	-	-	X	X	-	-	-	-	X	X	X	-	-	-	-	-	-	X	X
Coenonympha ampelos elko	-	X	X	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cercyonis pegala stephensi/9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cercyonis pegala ssp./10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Cercyonis pegala ssp./11	X	X	X	X	X	X	X	X	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Cercyonis pegala ssp./12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
Cercyonis pegala gabbii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WIDESPREAD GROUP																									
Ochlodes yuma	-	-	-	-	-	X	-	X	-	-	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-
Pieris protodice	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pieris rapae	X	X	X	X	X	X	X	X	-	X	X	-	X	X	X	X	X	X	X	X	X	X	X	-	X
Colias eurytheme	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Lycaena helloides	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X
Nymphalis antiopa	X	X	-	-	X	X	X	X	X	X	X	-	X	-	X	X	X	X	-	X	X	-	X	X	X
Vanessa atalanta rubria	-	-	-	-	-	X	-	X	-	-	-	-	-	-	X	X	X	X	-	X	X	-	-	X	-

Footnotes for Table 1:

[1]Numbers preceding locations correspond to those in Fig. 1
[2]More precise locations are as follows (all Nevada unless indicated):

1. lower valley from about Blythe, Riverside Co., CA to Davis Dam, Clark Co. (some data from Emmel and Emmel, 1973)
2. vicinity of St. George, Washington Co., UT (some data from Ferris and Brown, 1981)
3. Muddy River Valley, Overton to Moapa, Clark Co.
4. spring along U.S. 93, Lincoln Co.
5. valley south of Alamo, Lincoln Co.
6. northern Pahranagat Valley, vicinity of Hiko, Lincoln Co.
7. White River Valley, Wildlife Management Area, Nye Co.
8. White River Valley, county line to Preston, White Pine Co.
9. Meadow Valley Wash, Elgin to Caliente, Lincoln Co.
10. Spring Valley, north of Ursine, Lincoln Co.
11. Las Vegas Valley, vicinity of Las Vegas, Clark Co.
12. spring area, Desert National Wildlife Range, Clark Co.
13. spring area, Nye Co.
14. Amargosa Valley, Beatty to Springdale, Nye Co.
15. Pahrump Valley, vicinity of Pahrump, Nye Co.
16. Indian Springs and Cactus Springs, Clark Co.

[3]a distinct valley phenotype
[4]the apparently distinct *dammersi* has been recorded at Blythe and Overton
[5]*marginalis* is a synonym
[6]allied to the Steptoe Valley population (see Table 2)

Footnotes for Table 2:

[1]numbers preceding locations correspond to those in Fig. 1
[2]more precise locations are as follows (all Nevada):

17. National Wildlife Refuge area, Elko Co.
18. swales north and south of Currie, Elko Co.
19. vicinity of Warm Springs, White Pine Co.
20. vicinity of Shoshone, White Pine Co.
21. vicinity of Geyser Ranch, Lincoln Co.
22. 20-30 miles north of U.S. 50, White Pine Co.
23. along U.S. 50, west of Eureka, Eureka Co.
24. along U.S. 50, 13 mi. E Lander Co. line, Eureka Co.
25. wet areas near Duckwater, Nye Co.
26. Currant to 10 miles west, Nye Co.
27. vicinity of Lockes, Nye Co.
28. vicinity of Potts, Nye Co.
29. Carvers to Lander Co. line, Nye Co.
30. springs in vicinity of Sodaville, Mineral Co.
31. north of Dyer, Esmeralda Co.
32. Sheldon Antelope Range, Humboldt Co.
33. vicinity of Kings River, Humboldt Co.
34. Orovada to McDermitt, Humboldt Co.

35. south of Jackpot, Elko Co.
36. vicinity of Contact, Elko Co.
37. just south of Mountain City, Elko Co.
38. Wildhorse Creek Campground area, Elko Co.
39. vicinity of Charleston Reservoir, Elko Co.
40. south of Jack Creek, Elko Co.
41. Thousand Springs Creek, Elko Co.
42. vicinity of Elko, Elko Co.
43. just south of Carlin, Elko Co.
44. Pine Creek Valley, 20-30 miles south of Elko Co. line, Eureka Co.
45. Alpha Ranch area, Eureka Co.
46. just west of Dunphy, Eureka Co.
47. Beowawe to geyser area, Eureka/Lander cos.
48. along Humboldt River, north of Battle Mountain, Lander Co.
49. Reese River Valley, Nev. 305, 18-30 mi. N U.S. 50, Lander Co.
50. Reese River Valley in vicinity of U.S. 50, Lander Co.
51. just west of Winnemucca, Humboldt Co.
52. vicinity of Paradise Valley, Humboldt Co.
53. Rye Patch Dam to Mill City, Pershing Co.
54. north of Lovelock, Pershing Co.
55. canal just south of Fernley, Lyon Co.
56. south of Genoa, Douglas Co.
57. east of Carson City, Carson City
58. Fallon to Stillwater National Wildlife Refuge, Churchill Co.
59. U.S. 95, 11-13 mi. S Fallon, Churchill Co.
60. wet areas adjacent to East Walker River near CA line, Lyon Co.
61. Mason Valley near Yerington, Lyon Co.
62. spring area just north of Wabuska, Lyon Co.
63. vicinity of Schurz, Mineral Co.
64. vicinity of Washoe Lake, Washoe Co.
65. Truckee River in Wadsworth area, Washoe/Storey cos.

[3]very dark phenotype

[4]series of pallid populations, more than one taxon may be involved

[5]population at Dufurrena is closer to nominate *rubidus* than to *sirius*

[6]large pale phenotype, often tailless

[7]Ruby Valley population shows influence of nominate *nokomis*

[8]very pallid phenotype

[9]*blanca* is a synonym

[10]*gabbii* may not be the correct name, the phenotype was previously referred to *ariane*

[11]more than one taxon may be involved

[12]very different from Carson Valley population, shows some similarity to populations in northeastern Nevada